

DECSO emission versions

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The DECSO algorithm (Daily Emission estimation Constrained by Satellite Observations) has been applied successfully for NO_x emission estimation in East Asia, Middle East, South Africa, and India. As the algorithm is further improved, emission estimations are updated accordingly. Below you can find an overview of the different algorithm versions. An extensive algorithm description can be found in Mijling and Van der A (2012), and the GlobEmission ATBD.

Version 1

- CHIMERE V2006
- No biogenic emissions
- INTEX-B emission inventory
- Landuse by GLCF database (1993)
- European diurnal cycle
- Boundary conditions LMDzINCA (gas), GOCART (aerosol)

Used in:

- Mijling and Van der A (2012)
- GlobEmission, phase 1 (East Asia)

Version 2

- Modelling CHIMERE with sector-dependent emission injection heights
- Fast back-trajectory calculations
- Adjusted retrieval error tropospheric NO₂
- Update of NO_x-correlated pollutants
- Noise and bias reduction in remote areas
- Full Kalman matrix inversion using LDL decomposition
- Initial emission inventories:
 - South Africa: EDGAR v4.2, 2008
 - India: EDGAR v4.2, 2008

Used in:

- Mijling et al. (2013)
- GlobEmission, phase 1 (India, South Africa)

Version v3a

- CHIMERE V2006.
- Initial emission inventories:
 - East Asia: MEIC 2008 (China) + INTEX-B (outside China)
 - South Africa: EDGAR v4.2, 2008
 - Middle East: EDGAR v4.2, 2008
- Diurnal cycle: flattened for China, European for other regions.
- Calculation speed: switching from g95 to ifort compiler, and calculating matrix inversions with LAPACK

Used in:

- GlobEmission, phase 2 (East Asia, Middle East, South Africa)

The emission estimates show unrealistic day-to-day (and possibly month-to-month) fluctuations of emissions. Emission noise in low-emitting areas (introduction of positive emission bias, and unrealistic seasonal cycle when assimilating OMI measurements).

Version v3b

- CHIMERE V2013: new transport schemes, secondary organic aerosol chemistry, updated chemical reaction rates.
- New land use data: GlobCover Land cover (2009).
- Biogenic emissions by MEGAN
- Initial emission inventories:
 - East Asia: MEIC 2010 (China) + INTEX-B (outside China), regridded.
 - Middle East: HTAP v2 (EDGAR v4.3)
- Reduction of day-to-day emission fluctuations by OmF criterium [-5,10].
- Diurnal cycle: flattened for Middle East, European for East Asia.

Used in:

- Ding et al. (2015)
- GlobEmission, phase 2 (East Asia, Middle East)

Version 4

- Reduction of day-to-day emission fluctuations by 3-sigma (emission error) criterion
- New parametrization of R matrix
- Diurnal cycle: flattened

The emission noise is greatly reduced. The regional emission totals go down, but this is mainly related to the emission noise reduction (reduction of positive bias). Individual hot-spots, especially when undersampled, can disappear (e.g. Ulaanbaatar, and some power plants in North-East China). A slower convergence rate at changing emission signals?

Used in:

- GlobEmission, phase 2 (East Asia)

References

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